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# William Raymond Ledoux II

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<b>Education</b>	<b>Doctor of Philosophy in Engineering in Bioengineering</b> , August 1999 <i>University of Pennsylvania</i> , School of Engineering and Applied Science, Philadelphia, PA Concentrations: musculoskeletal modeling, emphasizing the foot; soft tissue biomechanics; gait analysis
	<b>Master of Science in Engineering in Bioengineering</b> , August 1993 <i>University of Pennsylvania</i> , School of Engineering and Applied Science, Philadelphia, PA Concentration: rehabilitation engineering
	<b>Bachelor of Science in Biomedical Engineering</b> , May 1992 <i>Rensselaer Polytechnic Institute</i> , School of Engineering, Troy, NY Concentration: materials science Minor: management
<b>Awards</b>	Solomon R. Pollack Award, 2000 presented annually to the graduating Bioengineering Ph.D. student at the University of Pennsylvania whose research “best demonstrates originality and is recognized as being at the forefront of its field” International Society of Biomechanics Congress Travel Grant, 1999 International Society of Biomechanics Matching Dissertation Grant, 1998 American Society of Biomechanics Student Travel Award, 1997 Ashton Fellowship, 1995 – 1999 Phi Kappa Tau Merit Scholarship, 1989, 1990, 1991
<b>Research Experience</b>	<b>Research Scientist</b> 8/99 – present <i>VA RR&amp;D Center for Excellence in Limb Loss Prevention and Prosthetic Engineering</i> , VA Puget Sound Health Care System, Seattle, WA <b>Projects:</b> finite element modeling of the human foot; mechanical properties of the plantar soft tissue; mechanical properties of ligaments of the foot; quantifying differences between foot types (high, low or neutral arches); motion of the bones of the foot during the gait cycle, with and without muscle imbalance
	<b>Affiliate Assistant Professor</b> 2/00 – present <i>Department of Orthopaedics, Harborview Medical Center, University of Washington</i> , Seattle, WA <b>Projects:</b> mechanical testing of spinal fixation techniques and of patellar/extensor mechanism complex
	<b>Research Assistant</b> 9/93 – 7/99 <i>Gait Study Center, Temple University School of Podiatric Medicine</i> , Philadelphia, PA <b>Projects:</b> computational model of the human foot; plantar soft tissue mechanical testing and constitutive modeling; pendulum impact testing of plantar soft tissue and orthotic materials; pennation angle of foot muscles; distributed ground reaction forces; normative acceleration of the calcaneus at heel strike; foot type biomechanics; pneumatic system design; phenomenological modeling of the foot; efficacy of orthoses; computer programming; gait service
	<b>Research Assistant</b> 2/98 – 8/98 <i>Biomaterials Study Center, Temple University School of Podiatric Medicine</i> , Philadelphia, PA <b>Projects:</b> effect of growth factors and polymer scaffolding on osteoblast growth
	<b>Research Assistant</b> 12/92 - 8/93 <i>Department of Bioengineering, The University of Pennsylvania</i> , Philadelphia, PA <b>Projects:</b> capacitive transducer prototype
<b>Work</b>	<b>Materials Engineer (Co-op)</b> 1/91 - 8/92

**Experience** *General Electric, Power Generation, Schenectady, NY*  
**Projects:** effect of increased nickel content on mechanical properties of high temperature alloys; continuous trend charts for 125+ forgings

**Materials Engineering Technician (Co-op)** 1/90 - 12/90  
*Allied Signal, Bendix Friction Materials Division, Green Island, NY*  
**Projects:** daily experience with materials testing procedures; study of friction characteristics of disc breaks

**Professional Affiliations** International Society of Biomechanics 1996 - present  
 American Society of Biomechanics 1994 - present  
 Gait and Clinical Movement Analysis Society 1995 - present  
 Biomedical Engineering Society 1995 - present

**Teaching Experience** Courses:  
 Biomechanics Laboratory - BE 510 (viscoelastic properties of skin, graduate level, 2 semesters)  
 Biomechanics Laboratory - BE 464 (viscoelastic properties of skin)  
 Biomechanics - BE 200 (2 semesters)  
 Biomaterials - BE 365  
 Bioengineering Laboratory - BE 209/BE 310 (2 semesters)  
 Engineering Math - BE 271  
 Responsibilities:  
 recitation instructor: lectured, solved problems, answered questions  
 laboratory instructor: generated background material, developed laboratory protocols, graded reports  
 teaching assistant: wrote and proctored exams, held office hours, graded homework and exams

**Publications (articles accepted for publication, submitted or in revision)**

Ledoux, W. R., Hirsch, B. E., Church, T. and Caunin, M. "Pennation angles of the intrinsic muscles of the foot," *accepted by the Journal of Biomechanics, July 2000*

Ledoux, W. R., and Hillstrom, H. J. "Acceleration of the calcaneus at heel strike in neutrally aligned and pes planus feet," *conditionally accepted by Clinical Biomechanics, May 2000*

Ledoux, W. R., and Hillstrom, H. J. "The distributed plantar vertical force of neutrally aligned and pes planus feet," *submitted to Gait and Posture, August 2000*

Ledoux, W. R., Camacho, D. L. A., Rohr, E. S., Ching, R. P., Sangeorzan, B. J. "The development of a computational three-dimensional model of the foot from CT images," *submitted to the Journal of Rehabilitation Research and Development, October 2000*

**Thesis** "A biomechanical model of the human foot with emphasis on the plantar soft tissue", Ph.D. thesis, Department of Bioengineering, University of Pennsylvania

**Abstracts (podium presentations and posters)**

- 1) Ledoux, W. R., Song, J., Hillstrom, H., Secord, D. and Kugler, F. "The design of a pneumatic validation system and its application to the static and dynamic accuracy of the Musgrave Footprint™ pressure plate system," Proceedings of the 16th Annual International Conference of the IEEE Engineering on Medicine and Biology Society Conference, Baltimore MD, 1994. (podium presentation)
- 2) Ledoux, W. R., Song, J., Hillstrom, H., Secord, D. and Kugler, F. "The static accuracy and repeatability of the Musgrave Footprint™ pressure plate system," Proceedings of the 2nd Annual Conference of the North American Clinical Gait Conference, Waterloo, Ontario; published in *Gait and Posture*, 3(2), p. 93, 1995. (podium presentation)
- 3) Ledoux, W. R., Hillstrom, H. J., Whitney, K., Song, J., Yoo, D., Sherer, R. G., and McGuire, J. "Pendulum based impact testing: An assessment of orthosis materials," Proceedings of the 1st Annual Conference of the Podiatric Research Society, New Orleans, LA, 1996. (podium presentation)

- 4) Hillstrom, H. J., Whitney, K., McGuire, J., Palamarchuk, H., Ledoux, W. R., Song, J., Bhimji, S., Friedman, I., Weikert, C., and Kugler, F. "Biomechanical assay of a specially designed insole for plantar fasciitis/heel spur syndrome," Proceedings of the 1st Annual Conference of the Podiatric Research Society, New Orleans, LA, 1996. (podium presentation)
- 5) Ledoux, W. R., Hillstrom, H. J., Yoo, D., Whitney, K., McGuire, and J, Song, J. "The mechanical testing of orthotic materials," Proceedings of the 2nd Annual Conference of the Podiatric Research Society, Palm Springs, CA, 1997. (podium presentation)
- 6) Hillstrom, H. J., Whitney, K., McGuire, J., Furmato, J., Brower, D., Bhimji, S., Song, J., Ledoux, W. R., Yoo, D., Sherer, R., and Brandeis, E. "Objective assessment of a preformed adjustable insole for use in a conventional diabetic shoe," Proceedings of the 2nd Annual Conference of the Podiatric Research Society, Palm Springs, CA, 1997. (podium presentation)
- 7) Ledoux, W. R., DeLott, J. M., Miller, R., and Hillstrom, H. "Evaluation of the distributed plantar vertical force in rectus and pes planus foot types," Proceedings of the 2nd Annual Conference of the North American Society of Gait and Clinical Movement Analysis, Chicago, IL; published in *Gait and Posture*, 5(2), p. 150, 1997. (podium presentation)
- 8) Ledoux, W. R., Hillstrom, H. J., Meaney, D. F., and Radin, A. "A quasi-linear, structural model of the soft tissue on the plantar aspect of the foot," Proceedings of the 21st Annual Conference of the American Society of Biomechanics, Clemson, SC, 1997. (podium presentation)
- 9) Ledoux, W. R., and Hillstrom, H. J. "Normative acceleration of the calcaneus at heel strike," Proceedings of the 3rd Annual Conference of the Podiatric Research Society, Orlando, FL, 1998. (podium presentation)
- 10) Ledoux, W. R., and Hillstrom, H. J. "Distributed ground reaction forces: barefoot versus viscoelastic socks," Proceedings of the 4th Annual Conference of the Podiatric Research Society, Los Angeles, CA, 1999. (podium presentation)
- 11) Ledoux, W. R., and Hillstrom, H. J. "A graphics-based, anatomically detailed, forward dynamic simulation of the stance phase of gait, emphasizing the properties of the plantar soft tissue," Proceedings of the 17th Congress of the International Society of Biomechanics, Calgary, AB, 1999. (podium presentation)
- 12) Ledoux, W. R., Hillstrom, H. J., and Meaney, D. F. "A quasi-linear, structural model of the plantar soft tissue with frequency dependent damping properties," Proceedings of the 23rd Annual Conference of the American Society of Biomechanics, Pittsburgh, PA, 1999. (podium presentation)
- 13) Ledoux, W. R., Camacho, D. L. A., Ching, R. P., and Sangeorzan, B. J. "A computational model of the human foot," Proceedings of the 2<sup>nd</sup> National VA Rehabilitation Research and Development Conference, Washington, D.C., 2000. p. p89 (poster presentation)
- 14) Ringleb, S. I., Ledoux, W. R., and Hillstrom, H. J. "The effects of change in pelvic height on the ground reaction forces in a biomechanical model of the human foot emphasizing the plantar soft tissue," Proceedings of the 5th Annual Conference of the Podiatric Research Society, Miami, FL, 2000. (podium presentation) p.
- 15) Ledoux, W. R., Camacho, D. L. A., Ching, R. P., and Sangeorzan, B. J. "The development and validation of a computational foot and ankle model," World Congress on Medical Physics and Biomedical Engineering, Chicago, IL, 2000., abstract No. TH-G325-2 (podium presentation)
- 16) Ledoux, W. R., Kato, A., Ching, R. P., and Sangeorzan, B. J. "Foot bone motion during midstance," The 24th Annual Conference of the American Society of Biomechanics, Chicago, IL, 2000., p. 241-42 (podium presentation)

- 17) Ledoux, W. R., Camacho, D. L. A., Ching, R. P., and Sangeorzan, B. J. "A finite element model of the human foot and ankle", Proceedings of the Ninth Annual Symposium on Computational Methods in Orthopaedic Biomechanics, San Francisco, CA, 2001

**Grants**

“Foot modeling: Plantar biomechanical properties”

Principal Investigator: Howard J. Hillstrom, Ph.D.  
 Role: Investigator (50%)  
 Sponsor: American Podiatric Medical Association  
 Project Period: 8/94 – 7/95  
 Total Direct Costs: \$6,040

“The properties of the soft tissues on the plantar aspect of the foot”

Principal Investigator: Howard J. Hillstrom, Ph.D.  
 Role: Investigator (50%)  
 Sponsor: Pennsylvania College of Podiatric Medicine  
 Project Period: 9/96 – 8/97  
 Total Direct Costs: \$3,025

“A biomechanical model of the human foot”

Principal Investigator: Howard J. Hillstrom, Ph.D.  
 Role: Investigator (50%)  
 Sponsor: Pennsylvania College of Podiatric Medicine  
 Project Period: 9/97 – 8/98  
 Total Direct Costs: \$5,395

“A forward dynamic simulator of the lower leg and foot”

Principal Investigator: William R. Ledoux, Ph.D. (50%)  
 Sponsor: International Society of Biomechanics  
 Project Period: 9/98 – 5/99  
 Total Direct Costs: \$4000

“Effect of motor imbalance on bony deformity and plantar pressure of the foot”

Principal Investigator: Bruce J. Sangeorzan, M.D.  
 Role: Investigator (20%)  
 Sponsor: Department of Veterans Affairs  
 Project Period: 8/00 – 7/03  
 Total Direct Costs: \$231,400

“Mechanical Properties of Plantar Soft Tissue in Shear and Compression” (funding begins 1/1/2001)

Principal Investigator: William R. Ledoux, Ph.D. (20%)  
 Sponsor: Department of Veterans Affairs  
 Project Period: 1/01 – 12/00  
 Total Direct Costs: \$49,600

“The Epidemiology of Foot Types in Diabetic Veterans with Plantar Ulcers”

Principal Investigator: William R. Ledoux, Ph.D. (10%)  
 Sponsor: VA/UW Seattle Epidemiologic Research and Information Center  
 Project Period: 10/00 – 9/01  
 Total Direct Costs: \$22,000

“Dynamic Stance Phase Simulations: Cadaveric and Computational Models” (LOI submitted 11/1/00)

Principal Investigator: William R. Ledoux, Ph.D. (25%)  
 Sponsor: Department of Veterans Affairs  
 Project Period: 10/01 – 9/04  
 Total Direct Costs: \$275,320

- Lectures** “Foot and ankle modeling: Foundations for a treatment simulator,” Thursday Evening Seminar Series at the Foot and Ankle Institute of the Pennsylvania College of Podiatric Medicine, November 1996
- Committees** The University of Pennsylvania Department of Bioengineering Chairperson Search Committee, 1995 - 1996  
The VA Puget Sound Health Care System Research and Development Committee (alternate), 2000 - present
- References**
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| <b>Bruce Sangeorzan, M.D.</b><br>VA Puget Sound, MS 151<br>1660 South Columbian Way<br>Seattle, WA 98108<br>(206) 764-2991<br><i>bsangeor@u.washington.edu</i>  | <b>Randal Ching, Ph.D.</b><br>Harborview Medical Center<br>325 9 <sup>th</sup> Avenue, Box 359798<br>Seattle, WA 98104<br>(206) 341-4001<br><i>rc@u.washington.edu</i>  |
| <b>Howard Hillstrom, Ph.D. (Ph.D. advisor)</b><br>Temple University School of Podiatric Medicine<br>Gait Study Center<br>8th and Race Streets<br>Philadelphia, PA 19107<br>(215) 625-5366<br><i>hhillstrom@tuspm.temple.edu</i> | <b>David Meaney, Ph.D. (Ph.D. co-advisor)</b><br>University of Pennsylvania<br>Department of Bioengineering<br>3320 Smith Walk, Rm 128 Hayden Hall<br>Philadelphia, PA 19104<br>(215) 573-3155<br><i>dmeaney@seas.upenn.edu</i> |